WHAT IS CLAIMED IS:

1. An optical sensor comprising:

an optical source capable of being positioned on a tissue and emitting infrared light into the tissue at a plurality of selected wavelengths;

a photodetector capable of detecting the selected wavelengths of light from the tissue, the photodetector being positioned on the tissue removed from the optical source but sufficiently close in proximity to the optical source to contact the same general tissue;

an oscillator coupled to the optical source and providing radio frequency modulation of the optical source, the optical source being responsive to the radio frequency modulation by emitting the plurality of selected wavelengths, the selected wavelengths being selected to generate measurable changes in absorbance of analytes of interest within the tissue.

2. An optical sensor according to Claim 1 further comprising:

a demodulator coupled to the photodetector and capable of detecting phase changes of a signal indicative of the radio frequency modulation for the selected wavelengths of light passing through the tissue to measure path length.

3. An optical sensor according to Claim 1 further comprising:

a wavelength modulator coupled to the oscillator and capable of controlling radio frequency modulation of the optical source to emit the plurality of selected wavelengths that are selected to generate the measurable changes in absorbance of analytes of interest within the tissue.

4. An optical sensor according to Claim 3 further comprising:

the wavelength modulator being capable of varying the wavelength of the light entering the tissue for a plurality of measurements to reduce scattering errors.

5. An optical sensor according to Claim 3 further comprising:

the wavelength modulator being capable of varying the wavelength of the optical source by varying temperature of the optical source.

6. An optical sensor according to Claim 3 further comprising:
the wavelength modulator being capable of varying the wavelength of the optical source using a micro-electro-mechanical system (MEMS) forming a portion of the optical source.

7. An optical sensor according to Claim 3 further comprising:
the wavelength modulator being capable of varying the wavelength of the optical source by varying drive current of the optical source.

8. An apparatus comprising:
a single optical source capable of emitting infrared light into the tissue at a plurality of selected wavelengths;
a detector capable of detecting the selected wavelengths of light in response to emission by the optical source;
an oscillator coupled to the optical source and providing radio frequency modulation of the optical source and wavelength variation of the optical source in the range of ±1% about the selected wavelengths; and
an analyzer coupled to the detector and coupled to the oscillator, the analyzer for analyzing changes in modulation intensity and phase between a signal from the optical source to the detector to measure absorbance of an analyte of interest within the tissue and determine concentration of the analyte according to an equation as follows:

$$\mu_a = \frac{\ln 10}{-2c}\left(\frac{dA/d\mu_a}{d\theta/d\mu_a}\right) = \frac{\ln 10}{-2c}\left(\frac{\Delta A}{\Delta\theta}\right)$$

where $dA/d\mu_a$ is a measured modulation amplitude difference over a slope of absorbance and $d\theta/d\mu_a$ is a measured phase change over the slope of absorbance, the slope of absorbance being defined from known absorbance characteristics of the analyte of interest over the selected wavelength variation range.

9. An apparatus according to Claim 8 wherein:

the oscillator further comprises:

a power supply; and

a temperature controller.

10. An apparatus according to Claim 8 wherein:

the analyzer is a demodulator capable of determining a phase difference θ of modulation between the emitted light and the reflected light and an amplitude A of modulation of the reflected light determined with in-phase and quadrature demodulation parameters.

11. An apparatus according to Claim 8 wherein:

the apparatus is a single wavelength pulse oximeter; and

the optical source is a single laser diode with a wavelength range of 760nm to 850nm that is wavelength shifted approximately ±2.5nm, the slope of absorbance between the wavelength-shifted points being equal to a blood oxygen saturation value.

12. An apparatus according to Claim 8 wherein:

the oscillator further comprises:

a power supply; and

a temperature controller; and

the power supply and temperature controller are capable of activating and modulating the optical source to emit the selected wavelengths in a range of wavelengths within one percent of the first nominal wavelength and to emit the selected wavelengths in a range of wavelengths within one percent of a second nominal wavelength.

13. An apparatus according to Claim 12 wherein:

the first nominal wavelength is 760 nm and is modulated between approximately +/- 5 nm;

the second nominal wavelength is 800 nm and is modulated between approximately +/- 5 nm; and

the first and second wavelengths measure oxyhemoglobin and deoxyhemoglobin concentration in tissue.

14. An apparatus according to Claim 13 further comprising:

a processor coupled to the analyzer and capable of noninvasively monitoring oxyhemoglobin and deoxyhemoglobin concentrations in fetal brains, the monitored concentrations being indicative of fetal hypoxia during labor and delivery, the optical source and the detector being capable of attachment to the fetal skull after the mother's membranes break with a low level suction.

15. An apparatus according to Claim 13 further comprising:

a processor coupled to the analyzer capable of measuring blood flow as a function of the difference between oxyhemoglobin concentration and deoxyhemoglobin concentration, the apparatus measuring blood flow noninvasively.

16. An apparatus according to Claim 13 further comprising:

a processor coupled to the analyzer capable of noninvasively measuring the concentrations so that measurements are made continuously and without risk of infection, bleeding, blood loss, or invasive procurement procedures.

17. An apparatus according to Claim 8 wherein:

the oscillator is capable of activating and modulating the optical source to emit the selected wavelengths in a range of wavelengths within one percent of the first nominal wavelength, emit the selected wavelengths in a range of wavelengths within one percent of a second nominal wavelength, and emit the selected wavelengths in a range of wavelengths within one percent of a third nominal wavelength.

18. An apparatus according to Claim 17 wherein:

the first nominal wavelength is 760 nm and is modulated between approximately +/- 5 nm;

the second nominal wavelength is 800 nm and is modulated between approximately +/- 5 nm;

the third nominal wavelength is 850 nm and is modulated between approximately +/- 5 nm; and

the first, second, and third wavelengths measure oxyhemoglobin, deoxyhemoglobin, and ferritin concentrations in tissue.

19. An apparatus according to Claim 18 further comprising:
a processor coupled to the analyzer capable of predicting patients at risk for acute respiratory distress syndrome that will progress to acute respiratory distress syndrome based on measurement of changes in ferritin concentration.

20. An apparatus according to Claim 18 further comprising:
a processor coupled to the analyzer capable of monitoring medication effects in acute respiratory distress syndrome patients.

21. An apparatus according to Claim 18 further comprising:
a processor coupled to the analyzer capable of noninvasively measuring ferritin concentration with or without iron-binding proteins.

22. An apparatus according to Claim 17 wherein:
the first nominal wavelength is 760 nm and is modulated between approximately +/- 5 nm;
the second nominal wavelength is 800 nm and is modulated between approximately +/- 5 nm;
the third nominal wavelength is 1620 nm and is modulated between approximately +/- 10 nm; and
the first, second, and third wavelengths measure oxyhemoglobin, deoxyhemoglobin, and carbon dioxide concentrations in tissue.

23. An apparatus according to Claim 22 wherein:
the apparatus is capable of measuring oxyhemoglobin, deoxyhemoglobin, and carbon dioxide concentration noninvasively in tissue.

24. An apparatus according to Claim 8 wherein:
the oscillator is capable of activating and modulating the optical source to emit the selected wavelengths in a range of wavelengths within one percent of the first nominal wavelength, emit the selected wavelengths in a range of wavelengths within one percent of a second nominal wavelength, emit the selected

wavelengths in a range of wavelengths within one percent of a third nominal wavelength, and emit the selected wavelengths in a range of wavelengths within one percent of a fourth nominal wavelength.

25. An apparatus according to Claim 24 wherein:

the first nominal wavelength is 760 nm and is modulated between approximately +/- 5 nm;

the second nominal wavelength is 800 nm and is modulated between approximately +/- 5 nm;

the third nominal wavelength is 850 nm and is modulated between approximately +/- 5 nm; and

the fourth nominal wavelength is 1620 nm and is modulated between approximately +/- 10 nm.

26. An apparatus according to Claim 25 wherein:

the first, second, third, and fourth wavelengths measure oxyhemoglobin, deoxyhemoglobin, ferritin, and carbon dioxide concentration in tissue.

27. An apparatus according to Claim 26 further comprising:

a processor coupled to the analyzer capable of noninvasively measuring the concentrations so that measurements are made continuously and without risk of infection, bleeding, blood loss, or invasive procurement procedures.

28. An apparatus according to Claim 26 further comprising:

a processor coupled to the analyzer capable of measuring oxyhemoglobin, deoxyhemoglobin, ferritin, and carbon dioxide concentration for improving diagnosis, treatment including specificity and dosing, or prevention of a pathophysiologic condition.

29. An apparatus according to Claim 28 further comprising:

a processor including a process for monitoring of exercise, aging, and related physiologic functions.

30. An apparatus according to Claim 26 further comprising:
a process executable in the processor capable of monitoring a condition and managing application of medication based on the monitoring.

31. An apparatus according to Claim 26 further comprising:
a process executable in the processor capable of monitoring a condition and managing automated application of inspired oxygen levels to minimal oxygen level requirements of a patient to supply effective oxygenation based on the monitoring.

32. An apparatus according to Claim 26 further comprising:
a process executable in the processor capable of measuring oxygen concentration in conditions of patients who are supplemented with additional concentrations of oxygen.

33. An apparatus according to Claim 26 further comprising:
a process executable in the processor capable of assessing perfusion following surgery or organ transplantation.

34. An apparatus according to Claim 26 further comprising:
a process executable in the processor capable of diagnosing stroke, transient ischemic attack, atherosclerosis, and anemia.

35. An optical sensor comprising:
means positionable on a tissue for emitting near infrared light into the tissue at a plurality of selected wavelengths;
means for detecting reflected light from the tissue, the means for detecting being positioned on the tissue removed from the emitting means but sufficiently close in proximity to the emitting means to contact the same general tissue;
means for activating the optical source to emit the near infrared light; and
means for controlling oscillation of the emitting means to emit a plurality of wavelengths that are selected to vary absorption amplitude and slope of a compound of interest within the tissue.

36. An optical sensor according to Claim 35 wherein:
the means for controlling oscillation is a means for controlling power and temperature of the emitting means.

37. A method of sensing a parameter comprising:
emitting near infrared light into the tissue at a plurality of selected wavelengths;
detecting reflected light from the tissue at a distance removed from the emission but sufficiently close in proximity to contact a same general tissue;
activating emission of the near infrared light; and
controlling oscillation of the emission to emit a plurality of wavelengths that are selected to vary amplitude and slope of absorbance of a compound of interest within the tissue.

38. A method according to Claim 37 wherein:
controlling oscillation of emission further comprises controlling power and temperature of the emission.

39. A method according to Claim 37 further comprising:
activating and modulating the emission to emit the selected wavelengths in a range of wavelengths within one percent of a first nominal wavelength; and
analyzing changes in modulation intensity and phase between light emitted into the tissue and light reflected from the tissue to determine a slope of absorbance of oxyhemoglobin, deoxyhemoglobin, carbon dioxide, and ferritin that is approximately linearly related to saturation according to an equation:

$$\mu_a = \frac{\ln 10}{-2c}\left(\frac{dA/d\mu_a}{d\theta/d\mu_a}\right) = \frac{\ln 10}{-2c}\left(\frac{\Delta A}{\Delta\theta}\right)$$

where $dA/d\mu_a$ is modulation amplitude difference and $d\theta/d\mu_a$ is a phase difference between two slightly shifted wavelengths in the selected range of wavelengths.